

Non-CO₂ Greenhouse Gases: Methane

Source/Sectors: Natural Gas Systems (Processing; Transmission)

Technology: Replace compressor cylinder unloaders (A.1.2.3.21)

Description of the Technology:

Natural gas produced from gas fields needs to be transported to distribution systems, power plants, or chemical plants through high-pressure pipelines. Compressor stations, which contain large reciprocating engines and turbine compressors, are used to move the gas throughout the United States. Natural gas is also injected and stored in subsurface formations, or liquefied and stored in aboveground tanks to meet the fluctuations in gas demand. Sources of methane emissions include emissions from compressors, metering, and regulating stations, dehydrators, and pneumatic devices (USEPA, 2006a).

Compressor cylinder unloaders are used to 1) reduce the machine's start-up load, 2) prevent an overload when there is an upset in operating conditions, and 3) control gas volumes due to fluctuations in rate requirements. Many older reciprocating engine-powered compressors are equipped with outdated or worn cylinder unloaders that continuously leak natural gas even when regularly maintained. Replacing the cylinder unloaders with a design that utilizes a balanced piston that avoids chatter and minimizes the pressure required for operation can reduce emissions (USEPA, 2004).

Effectiveness: A partner of the Natural Gas STAR program reported that a total of 14 MMcf per year of methane emissions were eliminated by replacing the worn unloaders on four compressors with those of a new design at one of their compressor stations (USEPA, 2008).

Implementability:

Compressor cylinder unloader replacement is applicable to compressors equipped with original unloaders that are experiencing maintenance problems (USEPA, 2008).

Reliability: The installation of the new compressor unloaders was approved on the basis of cost effectiveness, design, and safety.

Maturity: Good

Environmental Benefits: Methane emission reduction

Cost Effectiveness: The cost of a new unloader is less expensive than repairing the manufacturer equipped original ones. The partner realized estimated savings in excess of \$50,000 per unit per year. The savings include the value of the previously vented gas, reduced safety risks, and maintenance costs. The capital and labor costs to install the unloaders is \$40,000 to \$50,000 per unit (USEPA, 2008). Payout is in 0 to 1 year. Capital costs to replace and install the new unloaders were reported to be \$40,000 to \$50,000 per unit. However, these costs are justified based on the relatively short payback period and reduced O&M costs. Replacement also resulted in fewer unscheduled shutdowns and reduced methane emissions. The partner has plans to replace original unloaders on compressors at other stations (USEPA, 2008).

- Capital Costs (including installation) : >\$10,000
- Operating and Maintenance Costs (annual) : <\$100
- Payback (Years): 0-1

Industry Acceptance Level: Louisville Gas and Electric Company; Natural Gas Pipeline Company (now Kinder Morgan, Inc.)

Limitations: Re-piping of control lines and personnel trained in the proper maintenance of the new unloaders.

Sources of Information:

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5. International Energy Agency (2003) "Building the Cost Curves for the Industrial Sources of Non-CO₂ Greenhouse Gases", Report Number PH4/25, IEA Greenhouse Gas R&D Programme, Cheltenham, United Kingdom, October 2003.
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7. U.S. Environmental Protection Agency (2003) "International Analysis of Methane and Nitrous Oxide Abatement Opportunities: Report to Energy Modeling Forum, Working Group 21", a report prepared by ICF Consulting for the United States Environmental Protection Agency.
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